State of Arizona

Statewide Radio Interoperability Needs Assessment

Executive Summary

Introduction

Many Public Safety agencies struggle with outdated and inefficient telecommunications equipment that can preclude them from sharing vital information in a timely manner. In addition, the lives of citizens and the protection of property often depend on the ability of Public Safety personnel from one agency to communicate via mobile radio with personnel from other agencies, on demand, on location, and in real time — interoperability.

To remedy this situation and create seamless, coordinated, and integrated Public Safety communications, the State of Arizona created the Public Safety Communications Committee (PSCC) to build the support necessary to obtain funding for solutions to improve wireless communications interoperability statewide. The PSCC assignment is to establish the tactical deployment plan for an integrated and interoperable Public Safety Communications Network at the state and local levels throughout Arizona.

The State of Arizona under the auspices of the Arizona Public Safety Communications Committee (PSCC), and the leadership of the Arizona Department of Public Safety (DPS) through its legislated lead agency role, is seeking to develop a comprehensive plan for a Statewide Emergency Voice Radio Network (SEVRN). This network is part of what will be called the Arizona Wireless Integrated Network System (AZWINS).

DPS has retained the resources of Macro Corporation to evaluate current and future needs of all Public Safety and State Departments operating in the State of Arizona, develop at least three system configurations with cost estimates, and make a recommendation for a "Statewide Emergency Voice Radio Network".

The work by Macro Corporation is to be delivered to the State in two Phases, each culminating in a report, of which the Phase I report, detailing the needs of potential participants and entitled "Phase I Interim Report" was submitted to the state in December 2003.

The Phase II Final report, which contains the three most viable system configurations, and Macro's recommendation for the SEVRN system, along with supporting narrative and other material, is included herein.

Arizona Systems History

At present, each Department of the State, County, City, Town, Fire Department, Fire District, Tribal Nation and Federal Agency that requires wireless voice or data communications has, over many years, established its own private network to meet these requirements. In fact, the State of Arizona presently operates 18 individual mobile radio networks, each county operates a network, each city/town operates one or two networks, each Tribal Nation operates one or two networks, and each Federal Agency operates a network. In conclusion, there are well over 100, and perhaps closer to 200, mobile radio voice networks functioning in Arizona today. The majority of these systems were designed more than 20 years ago, and the needs of Public Safety today does not even closely resemble the functionality of the systems in place.

Condition of Existing Systems

With two significant exceptions; one being the new Phoenix/Mesa 800 MHz Project 25 digital trunking system still under implementation, and two; the new VHF narrowband system ordered by Cochise County, most Public Safety systems in Arizona are operating on an old and often unreliable infrastructure, and do not have the interoperability features deemed necessary for today's environment.

With some exceptions, there were really no significant differences between state, county, city, town, fire district or tribal systems with regard to coverage, reliability, interoperability, age, audio quality or grade of service.

Most systems are in the VHF and UHF band and do not conform to the FCC refarming rules. The manufacturer no longer supports a lot of the fixed equipment and spare parts are becoming very scarce. It won't be too long before some components or sub-systems will not be available, and major retrofit costs are necessary. Spending money to retrofit old systems is unwise, and has no long-term value.

Under rules that existed prior to February 25, 2003, there was no incentive for current users to migrate to narrowband operation as incurring the additional costs to do so did not yield any additional benefits to the users, and *in fact reduced their coverage footprint*.

Today narrowband licenses have primary status while wideband have secondary status.

Needs Analysis

One of the primary tasks in evaluation of the current and future needs of any Agency for voice communications is a requirements assessment. Requirements assessments are usually carried out by the conduction of a series of interviews with all potential users, including management and maintenance personnel. The analysis of the data collected from these interviews results in a set of requirements for each agency that uses mobile radio.

Macro conducted the normal interview process and provided further enhancement with the deployment of two Internet Questionnaires hosted on a Macro password protected server to encourage participation by as many users as possible.

Macro interviewed 118 Public Safety agencies on location in Arizona and received 171 responses to the Internet Questionnaires. On the basis of this information, an accurate and detailed needs analysis was derived for each type of agency determined to be a potential participant in the Statewide Emergency Voice Radio Network.

The needs of the potential state, county, city, town, fire district and tribal agencies are very similar. The Federal Agencies have some unique requirements due to their responsibilities.

A common set of needs was developed from the individual needs of each type of agency and documented in the Phase I report. In order to fulfill these needs, many system configurations and all frequency bands were examined, and the best solution evolved into our recommendation.

One important point -- all systems in Arizona operating on wideband VHF or UHF channels have to do something.

System Options

Macro examined all potential system configurations as options and selected the following three as the most viable:

i. Option 1 -- Project 25 Digital UHF Trunked System

ii. Option 2 -- Project 25 Digital UHF & 700 MHz Trunked System

iii. Option 3 -- Project 25 Digital 700 MHz Trunked System

System Recommendation

Macro Corporation's recommendation to the State of Arizona for a Statewide Emergency Voice Radio Network (SEVRN) is:

Option 3 -- Project 25 Digital 700 MHz Trunked System

Associated Recommendations

Macro Corporation further recommends that the State of Arizona:

a. Establish the PSCC as a legal entity in the State of Arizona, with a budget and some full time staff.

b. Establish a formal Governance Structure for SEVRN.

c. Permit the formal Governance Structure to establish a set of polices and regulations for the governance of SEVRN, with the first goal being the rules to join SEVRN.

d. Establish a Project Team under the auspices of the PSCC to design, procure, implement, test and maintain the SEVRN system.

e. Continue to market the concept of SEVRN through the PSCC and encourage as many participants as possible.

f. Mandate that all State Departments eventually use this system.

g. Take the necessary steps to procure a statewide digital trunked mobile radio system in the 700 MHz band conforming to the APCO Project 25 Phase 1 standards.

h. Take the necessary steps to procure a statewide microwave network and all associated infrastructure.

i. Take the necessary steps to procure all associated infrastructure for SEVRN, such as towers, buildings, civil works, etc.

j. Reduce DPS Dispatch Centers to two – a new one located in the Phoenix area, and a new one located in Flagstaff. A minimum of two Dispatch Centers is required to provide a Disaster Recovery solution and in addition, this is the most cost effective solution. One Center should be removed from major population areas and still have access the human resources for Dispatchers and technicians – Flagstaff fits this bill.

k. Construct two new Dispatch Centers, one in the Phoenix area, and one in Flagstaff.

l. Divide the State into two mobile radio Trunking Zones – one in the South associated with the new Phoenix Dispatch Center and one in the North associated with the new Flagstaff Dispatch Center.

m. Enhance the State's Disaster Recovery plan by implementing each Trunking Zone, such that, it can act as a backup for the other.

n. Provide for interoperability with the Sheriff's Departments, local Police Departments and any others still on VHF or UHF, by implementing a wideband/narrowband VHF or UHF channel at selected remote sites patched to a local talkgroup.

o. Enhance or extend the interoperability of any users not migrating to the SEVRN

p. Provide direct system-to-system digital interconnect or gateways to other trunking systems established at that time.

q. Arrange for reciprocal access the Phoenix-Mesa 800 MHz trunking system.

r. Transfer the CAD and RMS traffic on to the new digital microwave network.

s. Consider a 700 MHz wideband channel overlay for the state's MDC system.

Recommendation Considerations

In the formulation of our recommendation, Macro considered the following critical issues:

a. The recommendation best meet the needs identified in the Phase I Interim report entitled "Statewide Radio Interoperability Needs Assessment" for all Departments/Agencies.

b. Spectrum availability in the State of Arizona.

c. Creation of the maximum voice interoperability within the borders of Arizona.

d. Time is of the essence, due to the current condition of the DPS Microwave Network and other fixed infrastructure operated by state, county, and local government entities.

e. Most Public Safety Agencies in the state, with some exceptions, do not have any plans to conform to FCC refarming rules.

f. Our recommendation meets the generally accepted standards for Public Safety mobile radio systems and their associated infrastructure in the USA.

g. Present FCC regulations and future rule making.

h. It may not be possible to implement a statewide trunking system in the UHF band with enough capacity for all participants of SEVRN.

i. Two coverage options, each separately priced such that the state can limit initial costs, if necessary.

j. The maximum potential quantity of full participants for SEVRN.

k. Public Safety agencies continue to spend money to replace and upgrade existing systems in the State of Arizona, often with continued wideband operation.

l. Long-term protection of any State investment in mobile radio infrastructure.

m. The enhancement of state Disaster Recovery ability.

n. Maximization of RF channel and Dispatcher efficiencies.

o. Requirements for voice encryption (digital operation).

p. Minimization of State operating costs.

Recommendation Cost Estimate

There are large areas of the state not serviced by the present 52 DPS Highway Patrol sites or any other state government sites and these are identified as follows:

i. North West Corner (NW) – Approximately 2.0 % of state

ii. North East Corner (NE) – Approximately 2.8% of the state

iii. South Central Portion (SC) – Approximately 0.2% (Reduced by Quijotoa site)

These three areas represent approximately 5.0% of the total area of the state.

In order to allow the State flexibility in design, schedule, and particularly initial costs; Macro designated this 5 % of the state as Supplemental Coverage and all Options and Cost Estimates exhibit this fact.

The cost summary for the recommended 700 MHz system configuration option **without** the supplemental coverage is as follows:

FIXED EQUIPMENT	FIELD EQUIPMENT	MICROWAVE BACKBONE	RADIO SITE ELEMENTS	OUTSIDE TECHNICAL SERVICES	TOTAL COSTS
$ 71,182,679	$ 89,110,424	$ 40,767,846	$ 117,364,810	$ 1,600,000	**$ 320,025,759**

The cost summary for the recommended 700 MHz system configuration option **with** the supplemental coverage is as follows:

FIXED EQUIPMENT	FIELD EQUIPMENT	MICROWAVE BACKBONE	RADIO SITE ELEMENTS	OUTSIDE TECHNICAL SERVICES	TOTAL COSTS
$ 83,369,420	$ 89,110,424	$ 49,307,417	$ 155,622,304	$ 1,930,000	**$ 379,339,565**

For comparison purpose, the cost estimates of the three most viable options without the supplemental coverage are as follows:

OPTIONS	FIXED EQUIPMENT	FIELD EQUIPMENT	MICROWAVE BACKHAUL	RADIO SITE ELEMENTS	TOTAL COSTS
UHF Trunked	$53,300,874	$89,110,424	$35,728,990	$97,664,150	**$277,404,439**
UHF & 700 MHz	$55,901,844	$89,110,424	$41,171,909	$101,760,493	**$289,544,670**
700 MHz	$71,182,679	$89,110,424	$40,767,846	$117,364,810	**$320,025,759**

Note: All cost estimates are based upon a single large procurement.

Schedule

The overall time frame is nearly six years. If the state starts the design process in October 2004, the project will be completed in mid-2010.

Potential State Actions

In consideration of this Recommendation, the State may wish to consider other alternatives and options, such as:

a. An alternate solution in the extreme northwest and northeast corners of the State where land acquisition is difficult and mobile coverage is difficult and expensive.

b. Completing an inventory and evaluation of all existing towers in the State as these may provide substantial cost reductions. Cost estimates are based on a number of new sites and existing county or city tower sites may fulfill some of these requirements.

c. Examining the procurement options available, as large cost reductions are available by contracting for individual systems, rather than making one large procurement. Most Vendors mark-up subcontractor equipment and services in the range of 5 → 25 %. As an example, the savings on a 50 million dollar microwave network are substantial.

Course of Action

In light of all circumstances, the State should continue to pursue the recommended option, as it is in the best interest of the State, and the availability of 700 MHz spectrum will never get better.

Due to the age of the infrastructure operated by most agencies, time is of the essence, and the state should begin system design immediately, as this process will take between one and two years.